

ALL INDIA COORDINATED RESEARCH PROJECT ON SUGARCANE (AGRONOMY)

ANNUAL REPORT

2012-13



DEPARTMENT OF AGRONOMY

G.B. PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY PANTNAGAR
– 263145 (U.S. NAGAR) UTTARAKHAND

STAFF ASSOCIATED WITH THE PROJECT

- 1. Dr. Dheer Singh**
Professor
Department of Agronomy
- 2. Dr. Tej Pratap**
Senior Research Officer
Department of Agronomy
- 3. Mr. Vijendra Singh**
Junior Scientist
Department of Agronomy
- 4. Mr. R.D. Yadav**
Field Assistant
Department of Agronomy

TECHNICAL REPORT

The following Sugarcane experiments were allotted to the Pantnagar Centre during 2012-13

Experiment	Title
As-42	Agronomic evaluation of promising sugarcane genotypes planted in spring season
AS-63	Planting geometry in relation to mechanization in sugarcane
AS-64	Response of sugarcane crop to different plant nutrients in varied agro-ecological situations
As-65	Enhancing sugarcane productivity and profitability under wheat-sugarcane cropping system
As-66	Priming of cane nodes for accelerating germination in sugarcane

As per technical programme, all above experiments were conducted at the Norman E. Borlaug Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar during 2012-13. Pantnagar is situated at 29° N latitude and 79° E longitude and at an altitude of 243.8 m above the mean sea level in the foot hills of Himalayas (Shivalik Range) in Tarai region. The Tarai belt enjoys sub-humid tropical climate with hot summers and cold winter with minimum temperature in the range of 6.7° C – 7° C during 2012 January. (**Appendix-I**). Total rainfall in 74 days was received 1138.9 mm from January, 2012 to April, 2013. Maximum relative humidity ranges from 72.0 % in April, 2012 to 97% in Jan., 2013. Sunshine period was 4.2 hrs/day in January, 2012 and 9.0 hrs/day in April, 2013 (**Appendix-I**). The physio-chemical properties of the experimental soil are given in (**Appendix-II**). The experimental soil was silty loam in texture, rich in organic carbon (1.05 – 1.11 %), medium in available phosphorus 48.5 – 49.0 kg P₂O₅/ha and potassium (238 – 242 kg K₂O/ha) with soil pH 7.4-7.6. The cultural details of different experiments are given in (**Appendix-III**). Other details of the experiment are given experiment wise separately.

PROJECT NO. AS-42

Title : Performance of Sugarcane genotypes under different fertility levels in spring planted season

Year of

Experimentation : 2012-13

Site : N. E. Borlaug Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar

Experimental details

Treatments

1. Genotypes (4)

(i) Co Pant 5224

(ii) Co Pant 6224

(iii) Co Pant 4222

(iv) Co Pant 2218

2. Fertility levels (3)

(i) 75 % of the recommended N (90 kg/ha)

(ii) 100 % of the recommended N (120 kg/ha)

(iii) 125 % of the recommended N (150 kg/ha)

*Uniform dose of P₂O₅ (60 kg/ha) and 40 kg K₂O/ha were given as basal at the time of planting.

*Recommended dose of N was 120 kg/ha

Design : Randomized Block Design (R.B.D.)

Replication : 3

Plot Size : 30 m²

Net plot size : 18 m²

Date of Planting : 28.02.2012

Harvesting : 4.3.2013

Sugarcane crop was planted on February 28, 2012 at 75 cm row distance, keeping 3 budded 4 setts/m row length. Setts were treated with 0.25 % solution of carbendazin to prevent from fungal infection if any. Half dose of N as per treatment and full dose of P₂O₅ (60 kg) and K₂O (40 kg/ha) were given as basal and remaining N was top dressed in two splits within 90 days after planting. Cultural operations were performed as per recommendation and need of the crop. The experimental soil was silty loam in texture, rich

in organic carbon (1.05 %) and medium in available P₂O₅ (49.0 kg/ha) and K₂O (240.7 kg/ha) with neutral reaction (pH 7.4). The crop was harvested on 04.03.2013

Results : Data given in table-1 revealed that Germination % was significantly higher in the genotype Co Pant 5224 followed by Co Pant 2218 which was significantly higher over Co Pant 6224 and Co Pant 6224 at 45 DAP. Higher cane yield was recorded from genotype Co Pant 5224 followed by Co Pant 4222 which was significantly higher over Co Pant 2218. Higher cane yield was the combined effect of higher NMC, individual cane weight at harvest and higher shoot population at 120 DAP. Highest CCS yield was recorded in Co Pant 4222 which was significantly higher over Co Pant 6224. Sucrose % was also recorded higher in Co Pant 4222.

Highest cane yield was recorded in 125 % N of the recommended (150 kg N/ha) which was significantly higher over 75 or 100 % of the recommended N per ha. The higher cane yield in 125 % of the recommended N was the result of high NMC, higher individual cane weight and higher shoot population at different stages of crop growth. CCS yield was also higher in 125 % of the recommended N which was significantly higher over 75 or 100 % of the recommended N/ha.

Summary : Among genotypes Co Pant 5224 performed better followed by Co Pant 4222. Cane yield, NMC and average cane weight were higher in 125 % of the recommended (150 kg N) over 75 or 100 % recommended in sugarcane.

Table 1: Effects of genotypes and fertility levels on growth and yield of spring planted sugarcane at Pantnagar

Treatments	Germination (%) at 45 DAP	Shoot population (000/ha)			Average Cane weight (g)	NMC (000/ha)	Cane yield (t/ha)	Sucrose (%)	C.C.S. t/ha
		60 DAP	90 DAP	120 DAP					
Genotypes									
Co Pant 5224	43.8	101.2	142.6	165.3	967.8	87.2	85.9	15.9	8.5
Co Pant 6224	40.4	87.6	132.4	149.9	954.4	86.6	84.8	15.9	7.8
Co Pant 4222	41.2	95.3	134.8	157.7	976.7	87.0	85.0	16.2	8.8
Co Pant 2218	43.1	94.0	134.9	156.8	945.6	80.2	81.0	16.2	8.3
SEm ±	0.7	2.3	1.9	1.6	9.0	0.3	0.4	0.08	0.2
CD at 5%	2.1	6.9	5.7	4.8	27.0	0.9	1.6	0.24	0.8
Fertility levels (% of Recommended N)									
75	39.6	83.3	116.3	137.4	933.3	82.9	81.4	15.3	8.1
100	43.3	99.3	142.0	164.4	954.2	82.6	81.4	15.0	8.2
125	43.6	102.9	150.3	170.3	995.8	90.1	88.0	14.7	8.9
SEm±	0.8	2.6	2.2	1.9	10.4	0.3	0.5	0.09	0.2
CD at 5 %	2.3	7.9	6.6	5.6	NS	1.1	1.6	0.27	0.6

(Recommended dose of N was 120 kg/ha)

PROJECT NO. AS-63

Title	:	Plant geometry in relation to mechanization in sugarcane
Objective	:	1. To workout optimum plant geometry for use of farm machinery. 2. To study varietal response to different planting geometry.
Year of Experimentation	:	2012-13
Site	:	N. E. Borlaug Crop Research Centre of G. B. Pant University of Agriculture & Technology, Pantnagar

Experimental details

Treatments

[A] Plant geometry (3)

- (i) 120 cm row distance
- (ii) 150 cm row distance
- (iii) 30 : 120 cm paired row

[B] Genotypes (4)

- (i) Co Pant 3220 (erect)
- (ii) Co Pant 90223 (erect)
- (iii) Co Pant 97222 (Semi erect)
- (iv) Co Pant 99214 (Semi erect)

Design	:	Split Plot Design (S.P.D.)
Replication	:	4
Plot Size	:	8x6 (48 m ²)
Planting	:	24.2.2012
Date of Planting	:	28.02.2012
Harvesting	:	16.2.2013

Sugarcane crop was planted on 28.02.2012 at 120 cm, 150 cm and 30: 120 cm (paired) row distance, keeping 3 budded 4 setts per meter row length. Setts were treated with 0.25 % solution of emisan-6 to prevent fungal infection, if any. Half dose of N and total amount of P and K were applied as basal and remaining half of the N was top dressed in two splits within 90 days after planting. Cultural operations were performed as per recommendation and need of the crop. The experimental soil was silty loam in texture, rich

in organic carbon (1.05 %) and medium in available P₂O₅ (49.0 kg/ha) and K₂O (240.7 kg/ha) with neutral reaction (pH 7.5). The crop was harvested on Feb. 16, 2013.

Results: Highest cane yield was recorded from the treatment 30 : 120 cm (paired row) which was found significantly higher over rest of the two spacing (120 cm or 150 cm). Germination % was not influenced due to row spacing. Higher NMC, higher sucrose and higher CCS yield were also recorded in paired row planting (30 : 120 cm). Though the individual cane weight was higher in 150 cm row spacing (Table-2)

Cane yield was found significantly higher in genotypes Co Pant 90223 over the res. The higher cane yield from the genotype Co Pant 90223 was the result of higher, NMC at harvest which were reflected by number of shoots at 90 and 120 DAP. Germination % was higher in Co Pant 90223 and Co pant 99214, which were significantly higher over rest of the genotypes except Co Pant 99214.

Sucrose % was higher in 150 cm row distance where CCS yield was highest in 30 : 120 cm (paired row). Higher sucrose % was recorded in Co Pant 99214 which was significantly higher over Co Pant 90223 and at par with Co Pant 97222 and Co Pant 3220.

Summary : Highest cane yield was recorded from 30 : 120 cm paired row and genotype Co Pant 90223 among rest of the genotype. CCS yield was also highest in paired row (30 : 120 cm) spacing and in genotypes Co Pant 90223.

Table 2 : Sugarcane growth, cane yield (t/ha), sucrose (%) and CCS (t/ha) influenced by plant geometry and genotypes in relation to mechanization in sugarcane

Treatments	Germination (% at 45 DAP)	Shoot population (000/ha)		NMC (000/ha)	Cane yield (t/ha)	Sucrose (%)	C.C.S. t/ha	Per cane weight (g)
		90 DAP	120 DAP					
Plant Geometry (Row distance cm.)								
120	51.2	99.4	109.1	86.3	85.3	14.8	9.3	1018.1
150	50.7	95.4	100.5	74.2	74.4	15.2	8.7	1045.6
30:120 cm (paired row)	50.7	146.9	167.4	96.9	97.4	14.5	11.0	1000.0
Sem	1.3	3.3	5.3	1.0	0.7	0.09	0.1	10.0
CD at 5 %	NS	9.6	15.5	3.0	2.1	0.26	0.4	30.3
Genotypes								
Co Pant 3220	43.6	88.6	110.2	81.5	81.0	14.9	9.5	997.5
Co Pant 90223	56.8	139.9	144.8	98.1	99.9	14.5	11.1	1005.0
Co Pant 97222	47.6	112.2	120.4	82.2	80.9	14.9	8.8	1050.0
Co Pant 99214	55.5	115.0	127.3	81.5	80.9	15.0	9.4	1032.5
SEm±	1.5	3.8	6.2	1.1	0.8	0.01	0.1	12.0
CD at 5 %	4.5	11.1	18.6	3.4	2.5	0.03	0.4	36.0

PROJECT NO. AS-64

- Title** : Response of sugarcane crop to different plant nutrients in varied agro ecological situations
- Objective** : To study differential response of sugarcane crop to different nutrients
- Year of start** : 2011-2012
- Year of completion** : 2013-2014
- Treatments** :
1. Control (no fertilizer)
 2. N (120 kg/ha.)
 3. NP (120+60kg/ha.)
 4. NPK (120+60+40kg/ha.)
 5. NPK+S (120+60+40+40 kg/ha.)
 6. NPK+Zn (120+60+40+25 kg/ha.)
 7. NPK+Fe (120+60+40 kg/ha + 1% spray thrice in weekly interval at vegetative stage)
 8. NPK+Mn (120+60+40+50 kg/ha.)
 9. NPK+S+Zn (120+60+40+40+25 kg/ha.)
 10. NPK+S+Zn+Fe (120+60+40+40+25 kg/ha+1% spray thrice in Weekly interval at vegetative stage)
 11. NPK+S+Zn+Mn+Fe (120+60+40+40+25+50 kg/ha+1% spray thrice in weekly interval at vegetative stage)
 12. FYM @ 20 t/ha.
 13. Soil test based fertilizer application (150 kg N + 60 kg P₂O₅+ 40 kg K₂O)

Note:

- S : 40/60 kg/ha.-elemental sulphur (Subtropical / Tropical)
- Zn : 25/50 kg ZnSO₄/ha (Subtropical / Tropical)
- Fe : 1% spray thrice in weekly interval at vegetative stage)
- Mn : 50/100 kg MnSO₄ (Subtropical / Tropical)
- N P K : as per recommendations

- ❖ Experimental Design : RBD
- ❖ Number of Replications : 3
- ❖ Number of treatments : 13

- ❖ Date of planting : March 2, 2012
- ❖ Date of harvesting : February 27, 2013
- ❖ Gross plot size : 8.0 m x 3.75 m = 30 m²
- ❖ Net plot size : 7.0 m x 2.25 m = 15.75 m²

Sugarcane variety Co Pant 90223 was planted on March 2, 2012 at 75 cm row distance, keeping 3 budded 4 setts per meter row length. Setts were treated with 0.25% solution of Emissan (6 %) to prevent fungal infection. Fertilizer was applied as per treatment, (phosphorus, potassium, sulphur, zinc, iron and manganese) were applied along with half of the N as basal. Remaining N was given in two splits within 90 days after planting. Total five (5) irrigations were given prior to onset of the monsoon till June 2012. Cultural operations were performed as per recommendation and need of the crop. Crop was harvested on February 27, 2013.

Table 3: Effect of different treatments on sugarcane growth, yield and quality

Treatments	Germination (%)		Shoot population (000 ha ⁻¹)			Cane girth (cm)	Cane length (cm)	Cane wt. (kg)	NMC (000 ha ⁻¹)	Cane yield (t ha ⁻¹)	Juice sucrose % (at harvest)	CCS Yield (t ha ⁻¹)
	35 DAP	45 DAP	90 DAP	120 DAP	150 DAP							
T ₁	32.1	35.5	79.7	107.0	115.9	1.6	163	0.85	91.3	67.0	15.7	7.2
T ₂	43.6	48.8	108.7	123.7	130.0	1.7	217	1.01	99.5	84.4	16.2	9.6
T ₃	45.2	49.4	121.1	134.8	142.7	1.8	229	1.03	102.4	88.8	16.8	11.0
T ₄	46.1	50.2	120.1	142.2	146.7	1.8	232	1.03	103.1	90.6	16.9	12.1
T ₅	49.3	53.0	123.3	151.1	155.2	1.8	236	1.10	108.5	98.6	17.0	12.4
T ₆	50.4	54.4	142.2	191.9	199.6	1.9	244	1.13	110.8	101.0	17.3	13.3
T ₇	48.8	51.7	129.4	160.0	179.4	1.8	240	1.12	110.2	100.3	17.1	13.0
T ₈	47.8	51.2	122.1	145.3	151.4	1.8	234	1.04	104.1	90.8	16.9	12.1
T ₉	57.5	58.2	179.6	211.1	224.4	2.1	267	1.17	121.4	109.4	17.9	15.2
T ₁₀	53.0	55.0	175.0	207.2	218.0	1.9	254	1.17	116.4	106.6	17.8	14.9
T ₁₁	52.3	53.9	164.4	194.4	200.0	1.9	248	1.14	115.9	102.0	17.6	13.6
T ₁₂	39.6	44.4	93.1	110.7	122.0	1.7	207	0.91	96.6	80.0	16.2	8.4
T ₁₃	43.8	50.0	124.4	146.7	147.8	1.7	228	1.03	99.8	92.3	16.4	11.1
CD at 5 %	8.7	6.5	17.0	24.3	25.0	0.2	22.3	0.15	12.5	7.8	2.0	2.3

Result: Germination percent was recorded highest (57.5 % at 35 DAP and 58.2 % at 45 DAP) in T₉ which was found significantly higher over rest the treatments except T₁₀ and T₁₁ at 35 DAP & at 45 DAP. Shoot population at 150 DAP stage of crop growth was maximum shoots found in treatment T₉, which was significantly higher over remaining of the treatments except T₁₀ and T₁₁. Cane yield was recorded highest (109.4 t/ha.) in the treatment T₉ which was found significantly higher over rest of the treatments except the treatment T₁₀ and T₁₁. The higher cane yield was the cumulative effect of higher cane wt., cane length, cane girth and NMC/ha which were higher in these treatments over the rest. CCS yield was also highest in T₉ (15.2

t/ha) which was found significantly higher over rest of treatments but at par with the treatment T₁₀ and T₁₁ which was a due to higher juice sucrose per cent in cane at harvest (Table 3).

Table 4: Economics of different nutrient management in sugarcane

Treatment	Common cost (₹ ha ⁻¹)	Fertilizer cost (₹ ha ⁻¹)	Harvesting cost (₹ ha ⁻¹)	Transportation cost (₹ ha ⁻¹)	Total Cost of cultivation (₹ ha ⁻¹)	Gross return (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)
T ₁	63610	0	23435	6696	93741	190828	97087
T ₂	63610	1480	29556	8444	103090	240667	137577
T ₃	63610	4499	31068	8877	108054	252985	144931
T ₄	63610	5655	31716	9062	110042	258257	148214
T ₅	63610	11855	34496	9856	119817	280894	161077
T ₆	63610	7455	35350	10100	116515	287848	171334
T ₇	63610	7030	35117	10033	115790	285950	170160
T ₈	63610	5905	31792	9083	110390	258875	148485
T ₉	63610	13655	38278	10937	126480	311695	185215
T ₁₀	63610	15030	37299	10657	126596	303723	177126
T ₁₁	63610	15280	35709	10202	124801	290769	165968
T ₁₂	63610	15000	28000	8000	114610	228000	113390
T ₁₃	63610	6034	32296	9228	111168	262984	151816

Data given in table 4 revealed that these were the differences in cost of cultivation, gross return and net return owing to different treatments and maximum cost of cultivation, gross return and net return found in the treatment T₉ which was fertilized with (NPK+Zn+S). However, the minimum cost of cultivation, gross return and net return recorded in treatment T₁ (control plot). Cost and sale price of the treatments is given in **Appendix - iv**

❖ **Summary:** The highest cane yield was observed in T₉ treatment in which the crop was fertilized with NPK+Zn+S (120+60+40+40+25 kg/ha). The cane yield was also found similar to T₉ in the treatment T₁₀ (NPK+S+Zn+Fe, 120+60+40+40+25kg/ha+1% spray thrice in weekly interval at vegetative stage) and in T₁₁ (Mn was given @ 50 kg/ha along with the nutrient given in T₁₀). The cane yield was non-significant in between the treatments T₉, T₁₀ and T₁₁.

Data given in table 4 showed that higher net return (1,85,215 `/ha) was recorded from the treatment T₉ followed by treatment T₁₀ and T₆. Lowest net return was recorded from the control, followed by treatment T₁₂ (FYM @ 20 t/ha) (1,13,390 `/ha). It is evident from the table that net return was increased due to increased cane yield in which micro-nutrients particularly (Zn, S, and Fe) were given along with NPK.

Table 5 (a) : Effect of different nutrient on nutrient availability in soil as influenced by the application of different macro/micro nutrients in sugarcane

Treatments	pH	EC (dSm ⁻¹)	Organic Carbon (%)	Available N (kg ha ⁻¹)	Available P (kg ha ⁻¹)	Available K (kg ha ⁻¹)	Available S (kg ha ⁻¹)	Available Zn (mg kg ⁻¹) (soil)	Available Fe (mg kg ⁻¹) (soil)	Available Mn (mg kg ⁻¹) (soil)
T ₁	6.7	0.19	0.98	173.3	41.0	170.3	40.4	0.77	30.3	35.3
T ₂	6.7	0.18	1.04	172.6	38.8	166.5	37.2	0.67	29.4	34.2
T ₃	6.8	0.18	1.13	170.7	34.8	167.3	35.3	0.66	29.2	33.6
T ₄	6.9	0.19	0.96	165.5	37.1	169.2	39.4	0.64	31.4	32.3
T ₅	6.9	0.20	1.06	168.5	37.5	172.6	47.5	0.71	30.5	31.7
T ₆	6.9	0.19	1.07	164.1	38.4	175.0	43.1	1.04	32.3	32.1
T ₇	6.7	0.18	1.09	168.7	40.7	174.3	39.0	0.66	33.6	32.4
T ₈	6.8	0.18	1.11	165.7	40.7	175.1	45.7	0.65	31.9	44.1
T ₉	6.9	0.20	0.91	162.8	40.1	176.0	46.5	1.03	31.7	32.0
T ₁₀	7.0	0.20	1.09	162.0	40.8	177.3	53.2	1.05	31.5	43.2
T ₁₁	6.7	0.20	1.03	161.3	39.1	179.6	53.7	1.04	33.7	44.0
T ₁₂	6.7	0.19	1.15	170.2	37.6	165.0	38.4	0.64	30.3	35.7
CD at 5 %	ns	ns	ns	ns	ns	ns	10.6	0.33	ns	ns

Data given in table 5 (a) revealed that highest available S in soil was recorded in the treatment T₁₁ (53.7 kg/ha) and it was significantly higher over the treatments T₁, T₂, T₃, T₄, T₅, T₇ and T₁₂. Available Zn was found highest in T₁₀ (1.05 mg kg⁻¹) soil which was significant higher over remaining of the treatments except treatment T₁, T₅, T₆, T₉, T₁₁. Non-significant variation in residual soil nutrient status might be the fact that all the treatment received same amount of NPK.

Table 5 (b): Categories of available nutrients in soil (kg/ha).

Nutrients	Low	Medium	High
Nitrogen (kg/ha)	<280	280-560	>560
Phosphorous (kg/ha)	< 10	10-22.5	>22.5
Potassium (kg/ha)	<117	117-280	>280

PROJECT NO. AS-65

Title : Enhancing sugarcane productivity and profitability under wheat- sugarcane cropping system

Year of start : 2012-13

Treatments :

T₁ - Autumn planted sugarcane

T₂- T₁ + wheat (1:2)

T₃ - T₁ + wheat (1:3)

T₄ – Wheat sown on 15th November – late sugarcane

T₅ - Wheat sown on 15th December – late sugarcane

T₆- FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of February

T₇- FIRB sowing of wheat 15th November (75 cm with 3 row of wheat) + sugarcane in furrow in 3rd week of March

T₈ – T₆ with 15th Dec. Sowing of wheat

T₉ – T₇ with 15th Dec. Sowing of wheat

Design : Randomized Block Design

Replication : 3

Wheat variety : UP 2565,

Sugarcane Variety : Co Pant 90223

Plot size : 8x5.4 = 43.2 m²

Net plot : 36 m²

Sowing of sugarcane

T₁- 15 October, 2011

T₂- 15 October, 2011

T₃-15 October, 2011

T₄- - 6 May, 2012

T₅- 17 Feb., 2012

T₆- 17 Feb., 2012

T₇- 19 March, 2012

T₈- 17 Feb., 2012

T₉- 19 March, 2012

Harvesting of sugarcane

8 January, 2013

8 January, 2013

8 January, 2013

7 April, 2013

19 March, 2013

19 March, 2013

19 March, 2013

19 March, 2013

19 March, 2013

Wheat variety UP 2565 and sugarcane variety Co Pant 90223 were planted as per technical programme and crop were raised as per recommended practices and as per need of the crop. The soil of the crop was silty loam in texture having organic carbon (1.05 %) and medium in available P₂O₅ (49.0 kg/ha) and K₂O (240.0 kg/ha) with neutral reaction (pH 7.3).

Results :

(i) **Wheat :** Highest grain yield of wheat was recorded from the treatment (T₄) in which wheat was on November 15 which was significantly higher over rest of the treatments (Table -6)

(ii) **Sugarcane :** Highest cane yield (74.7 ton/ha) was recorded from (T₁- Autumn planted sugarcane) which was significantly higher over rest of the treatments except the treatment T₂ in which two rows of wheat were sown in between two rows of sugarcane. The sugarcane productivity was reduced due to delay in sugarcane planting after harvest of wheat. Planting of 3 rows (1:3) also reduced the sugarcane productivity. Sugarcane productivity was almost the same in T₆ and T₇ in which wheat 3 rows were sown on FIRB and sugarcane was planted in blank rows (made from excavated soil for FIRB), for T₆ sugarcane was planted in furrows during last February and in T₇ sugarcane was planted during last March. In these two treatments the germination % was almost the same at 45 DAP. NMC and cane weight (individual) were almost similar. Sugarcane equivalent yield was calculated highest in T₂ (Autumn planted sugarcane along with two rows of wheat (in between two rows of sugarcane.)) Sucrose % and CCS yield at harvest of the sugarcane were highest in Autumn planted cane in T₁, T₂ and T₃. (irrespective of sown alone or with wheat) Table – 7.

Summary : Highest grain yield was recovered in 15th November sown crop. The highest grain yield was the effect of higher tiller/m² in T₄.

Highest sugarcane yield was recorded from autumn planted cane as compared to either late sown (sown after wheat harvest) or sown in skipped furrow. The cane yield was also influenced due to sowing of wheat 3 rows on ridge (FIRB) in autumn planted cane. Sugarcane quality was also good in autumn planted, cane either sown alone or with 2 or 3 rows of wheat in between two rows of sugarcane.

Table 6 : Effect on wheat productivity under wheat-sugarcane cropping system

Treatment	Tillers count in wheat/m ²			Straw yield (q/ha)	Yield (q/ha)
	30	60	90		
T ₁	-	-	-	-	-
T ₂	262.0	269.0	268.0	47.0	47.0
T ₃	274.0	277.7	396.0	53.3	52.0
T ₄	283.0	292.3	300.0	55.3	54.3
T ₅	246.0	264.3	293.0	42.2	41.2
T ₆	232.7	269.3	283.7	44.5	43.5
T ₇	248.3	257.3	275.7	44.2	43.4
T ₈	251.0	268.0	280.0	31.6	30.6
T ₉	264.3	279.0	287.0	30.4	29.5
SEm±	21.6	20.0	21.0	0.0	0.6
CD at 5 %	64.2	61.0	63.2	1.6	1.8

Table 7: Enhancing sugarcane productivity and profitability under wheat-sugarcane cropping system.

Treatment	Ger. % at 45 DAP	Shoot population			Plant height at harvest (cm)	Plant girth (cm)	NMC 000/ha	Cane weight (g)	Yield (t/ha)	Sucrose % at Nov.	Sucrose % at harvest	C.C.S. (t/ha)	Equivalent yield of sugarcane (q/ha)
		90	120	180									
T ₁	21.6	50.2	54.9	217.3	236.7	2.0	88.8	1000.0	74.7	15.3	17.1	8.0	673.0
T ₂	21.3	47.5	50.1	198.7	194.0	2.0	79.1	983.3	70.3	15.6	16.5	7.1	953.0
T ₃	21.1	46.8	48.3	183.7	221.0	1.9	69.2	983.3	62.7	16.6	16.4	6.5	862.7
T ₄	25.7	41.7	43.9	241.7	165.7	1.9	63.3	700.0	60.7	14.2	15.2	5.1	807.8
T ₅	25.2	41.4	42.5	60.0	146.0	1.8	53.4	666.7	51.3	14.1	15.3	4.5	704.5
T ₆	26.2	44.5	51.0	86.6	175.0	1.9	73.1	893.3	67.3	15.2	15.9	6.0	756.5
T ₇	28.4	45.0	52.3	85.3	182.0	1.9	73.1	906.0	69.0	15.2	16.9	6.1	756.0
T ₈	25.5	40.9	51.4	74.7	186.3	1.9	71.8	850.0	68.7	15.3	15.7	6.0	694.0
T ₉	27.4	44.6	50.1	74.7	175.7	1.7	71.5	870.0	68.7	15.5	16.5	6.3	945.7
SEm±	0.5	0.9	1.1	57.4	5.0	0.4	2.6	19.0	1.4	0.2	0.03	0.1	-
CD at 5 %	1.7	2.9	3.4	NS	15.0	0.13	8.0	57.0	4.3	0.6	1.0	0.3	-

PROJECT NO. AS-66

Title	:	Priming of cane node for accelerating germination in Sugarcane
Observation	:	(i) To find out suitable cane node priming technique (ii) To assess the effect of cane node on acceleration of Germination and productivity of sugarcane
Year of start	:	2012-13
Treatments (6)	:	
	T1	: Un-primed cane node
	T2	: Treating cane node in hot water at 50 °C for 2 hours.
	T3	: Treating cane node in hot water at (50 °C) + urea solution (3 %) for 2 hours
	T4	: Priming cane node with cattle dung, cattle urine and water in 1:2:5 ratio.
	T5	: Conventional 3 bud sett planting.
	*T6	: Primed and sprouted cane node (Incubated for 4 days after priming).

(*) Put the single cane node in the slurry of cattle dung, cattle urine and water for 15 minutes. Take out the buds and put in decomposed FYM and cover it with sugarcane trash for 4-5 days for sprouting.

Design	:	Randomized Block Design
Replication	:	4
Variety	:	Co Pant 99214
Date of sowing	:	15.3.2012
Date of harvesting	:	18.3.2013
Plot size	:	22.5 m ²
Net plot	:	13.5 m ²

The sugarcane variety Co Pant 99214 was planted on 15.3.2012 at 75 cm row distance as per technical programme treatments. Recommended dose of NPK (120 : 60 : 40 kg/ha) was given to the crop. Half dose of nitrogen and full dose of P₂O₅ (60 kg/ha) and K₂O (40 kg/ha) were applied as basal and remaining half nitrogen was top dressed in two splits within 90 days after planting (before onset of the monsoon). Cultural operations were given as per recommendation and need of the crop. The soil of experimental field was silty loam in texture rich in organic carbon (1.05 %) and medium in available P₂O₅ (49.0 kg/ha) and K₂O (240.4 kg/ha) with neutral in reaction (pH 7.3). The crop was harvested on 18.3.2013.

Results : Germination of sugarcane was recorded highest at 20 DAP in the treatment (T₃) hot water at 50 °C + 3 % urea solution for 2 hours which was found significantly higher over unprimed (T₁) and sprouted cane node incubated for four days after priming (T₆). Lower germination was recorded in T₁ unprimed cane node, at 20 DAP. Germination % was sustained at 30 and 40 DAP in hot water treatment (50 °C) with 3 % urea. The highest cane yield was recorded in the treatment of conventional 3 bud setts which was significantly higher over rest of the treatments except T₂ (hot water treatment at 50 °C) for two hours. The higher yield in these treatments was the result of higher shoot population, NMC, cane weight. Highest sucrose % was also recorded in 3 budded setts treatment which was significantly higher over unprimed (T₁). CCS yield was also recorded highest in T₅ (conventional 3 bud setts) which was found significantly higher over rest of the treatments except T₂ (treatments cane node in hot water at 50 °C) for two hours. Lowest CCS yield was recorded in T₁ (unprimed). Table - 8

Summary: Higher germination at 20 DAP was recorded in the treatment of (T₃) - hot water at 50°C + 3 % urea solution for 2 hours and even sustained at 30 and 40 DAP. Higher cane yield was recorded in the treatment of conventional 3 budded setts which was significantly higher over rest of the treatments except T₂- (50 °C hot water treatment for 2 hours). CCS yield was recorded highest in T₅- conventional 3 bud setts sowing.

Table 8 : Effect of priming / treatment on germination, growth and yield & quality of sugarcane

Treatments	Germination %			Shoot population %				NMC 000/ha	Yield t/ha	Sucrose % Nov.	Sucrose % At harvesting	CCS t/ha	Average cane weight (g)
	20 DAP	30 DAP	40 DAP	60 DAP	90 DAP	120 DAP	150 DAP						
T1-Un-primed cane node	14.0	28.3	45.0	86.8	93.8	96.1	85.8	68.7	64.8	14.9	16.5	7.0	1005.0
T2-Treating cane node in hot water at 50 °C for 2 hours	38.6	49.8	69.3	87.3	112.0	114.9	113.5	82.1	96.6	15.4	17.2	11.3	1147.5
T3-Treating cane node in hot water at (50 °C) urea solution (3 %) for 2 hours	44.3	54.5	73.5	106.8	113.5	125.7	121.8	89.3	67.4	15.4	16.9	7.5	1311.3
T4-Priming cane node with cattle dung, cattle urine and water at 1:2:5 ratio	32.0	42.8	52.5	95.3	118.3	109.8	107.8	73.5	70.4	15.8	17.3	8.0	1012.5
T5-Conventional 3 bud sett planting	31.5	45.3	56.0	193.8	171.7	175.7	169.8	148.5	101.3	14.8	17.2	11.7	1315.0
T6-Primed and sprouted cane node (Incubated for 4 days after priming)	23.0	32.3	50.5	67.5	78.0	101.3	101.5	85.9	78.3	15.4	17.2	8.9	1173.8
SEm±	4.0	3.7	4.2	11.8	16.8	8.7	7.4	5.7	2.3	0.16	0.14	0.31	13.0
CD at 5 %	13.5	11.4	12.9	35.8	50.8	26.3	22.4	17.4	7.1	0.48	0.43	0.94	39.4

Appendix I : Metrological observations recorded during experimental period (January, 2012 to April, 2013) at Pantnagar.

Month	Temperature °C		Rel. Humidity (%)		Rainfall (mm)	No. of rainy/ days	Wind speed Km/h	Sunshine hrs./day	Evap. (mm)
	Max	Min.	0712	1412					
Jan., 2012	19.4	6.7	91	62	025.2	7	4.3	04.2	1.6
Feb. , 2012	23.9	8.0	90	40	000.6	1	5.7	06.7	2.7
March, 2012	29.1	12.1	89	40	003.8	2	4.1	07.4	4.8
April, 2012	34.8	18.5	72	33	007.4	3	6.6	08.7	8.2
May, 2012	39.0	21.1	59	24	000.0	0	7.1	09.4	10.6
June, 2012	40.1	25.9	62	30	021.2	2	9.9	07.5	11.4
July, 2012	33.4	26.3	85	66	269.2	19	5.3	04.0	5.5
Aug. , 2012	31.8	25.5	89	73	391.8	18	5.5	03.5	4.1
Sept. , 2012	31.8	23.9	89	68	224.6	12	4.1	06.4	4.2
Oct. , 2012	31.2	16.1	88	44	000.0	0	2.4	8.6	3.2
Nov. , 2012	27.2	9.9	90	37	000.0	0	2.3	6.9	2.6
Dec. , 2012	21.3	7.15	91	55	000.0	0	3.8	4.6	2.30
Jan. , 2013	16.0	5.7	97	71	041.2	2	4.2	03.1	1.2
Feb. , 2013	22.8	9.9	91	56	132.1	6	4.8	06.0	2.5
March, 2013	29.1	13.5	89	44	013.4	1	3.7	08.6	3.7
April, 2013	35.0	17.6	68	26	008.4	1	6.9	09.6	7.8

Appendix- II: - Physico-chemical properties of the experimental soil.

Attributes	AS-42	AS-63	AS-64	AS-65	AS-66
Texture	Silty loam	Silty loam	Silty loam	Silty loam	Silty loam
Organic carbon %	1.05	1.04	1.04	1.05	1.08
Available P ₂ O ₅ (kg/ha)	49.0	47.6	47.0	49.0	48.6
Available k ₂ o (kg/ha)	240.7	240.7	240.5	240.7	240.7
Soil pH	7.4	7.4	7.2	7.5	7.4

Appendix- III: - Details of different experiments.

Experiment	Varieties	Planting date	Date of harvesting	Fertilizer dose (kg/ha)
AS-42	Co Pant 5224 Co Pant 6224 Co Pant 4222 Co Pant 2218	28.02.12	4.03.2013	N as per treatment (Recommended dose N 120 kg/ha P 60 kg/ha and K 40 kg/ha)
As-63	Co Pant 3220 Co Pant 90223 Co Pant 97222 Co Pant 99214	28.02.12	16.03.2013	NPK as per recommended dose
As-64	Co Pant 90223	02.03.2012	27.02.2013	NPK and micro nutrients as per recommended dose
As-65	Co Pant 90223	As per treatment	As per treatment	NPK as per recommended dose
As-66	Co Pant 99214	15.03.2012	18.03.2013	NPK as per recommended dose

Appendix IV: Price, cost and man power used in the experiment

Name of operation	No. of operation	Price (₹)
1. Land preparation		
Pre-sowing irrigation	01	1000 ₹/irrigation/ha
Labour for pre-sowing irrigation	02	
Harrowing	05	150 ₹/labour
Planking	02	
2. Fertilization application		
Nitrogen (Urea)	120 kg/ha	1000 ₹/harrowing/ha
Phosphorus (DAP)	60 kg/ha	500 ₹/planking/ha
Potassium (MOP)	40 kg/ha	5.7 (₹/kg)
Sulphur (Elemental sulphur)	40 kg/ha	17.0 (₹/kg)
Iron (Iron sulphate)	25 kg/ha	24.16 (₹/kg)
Zinc (Zinc sulphate)	25 kg/ha	155 (₹/kg)
Manganese (Manganese sulphate)	50 kg/ha	55 (₹/kg)
FYM	20 t/ha	72 (₹/kg)
Labour	05	50 (₹/kg)
3. Sowing		
Furrow opening	01	75 (₹/kg)
Seed cost	60q	150 ₹/labour
Labour (planting + covering)	30	2500 ₹/ha
4. Irrigation		
Irrigation	05	300 ₹/q
Labour	10	150 ₹/labour
5. Weeding		
I	25 (labour)	1000 ₹/irrigation/ha
II	25 (labour)	150 ₹/labour
III	25 (labour)	150 ₹/labour
6. Chemical treatments		
Seed treatment	500gm/ha (Emissan)	150 ₹/labour
Pest control	30kg/ha (Furadan)	150 ₹/labour
Labour	03	520 ₹/kg
7. Tying		
Labour	25 (labour)	70 ₹/kg
8. Earthing up		
Labour	25 (labour)	150 ₹/labour
9. Miscellaneous		
10. Harvesting		
11. Transportation		
		150 ₹/labour
		150 ₹/labour
		2500 ₹
		40 ₹/q
		10 ₹/q